

Amendments to the Specification

Page 1, final paragraph to Page 2, first paragraph, please amend as follows;

On the other hand, the tripod 5 secured at one end of the second rotating shaft 4 comprises a unified form of a boss 7 for supporting the tripod 5 at one end of the second rotating shaft 4, and trunnions 8 formed on three locations at equal spacing around the boss 7 in the circumferential direction. Around the respective trunnions 8 each of which is cylindrically formed, rollers 9 are rotatably supported through a needle bearing 10, while allowing the rollers 9 to be displaced in the axial direction by certain distances. A joint is provided by engaging the respective rollers 9 with the ~~recess~~ grooves 6 on an inner face of the housing 3. ~~The r~~ Respective pairs of side faces 11, on which each of the above ~~recesses~~ grooves 6 is provided, are formed to circular recesses. Accordingly, each of the rollers 9 is rotatably and pivotably supported between the respective pairs of the side faces 11.

Page 2, first full paragraph, please amend as follows;

When the constant velocity joint 1 as described above is used, for example, the first rotational shaft 2 is rotated. The rotational force of the first rotational shaft 2 is, from the housing 3, through the roller 9, the needle bearing 10 and the trunnion 8, transmitted to the boss 7 of the tripod 5, thereby rotating the second rotational shaft 4 the end of which is fixed to the boss 7. Further, if a central axis of the first rotational shaft 2 is not aligned with that of the second rotational shaft 4 (namely, a joint angle is not zero in the constant velocity joint 1), each of the trunnion 8 displaces relative to the side face 11 of each of the ~~recesses~~ grooves 6 to move around the tripod 5, as shown in Figures 15 and 16. At this time, the rollers 9 supported at the ends of the trunnions 8 move along the axial directions of the trunnions 8, respectively, while rolling on the side faces 11 of the ~~recesses~~ grooves 6, respectively. Such movements ensure that a constant velocity between the first and second rotational shafts 2 and 4 is achieved, as is well known.

Page 4, last paragraph to page 5 first paragraph, please amend as follows;

In order to attain the above object, a constant velocity joint of tripod type

according to the first aspect of the invention comprises [.] a cylindrical hollow housing defining an opening at one end. [, and being] The housing is secured at its opposite end to a first rotating shaft such that a central axis of the housing is aligned with that of the first rotating shaft. [, a] An inner face of the housing [being] is provided with three guide grooves extending in [a] an axial direction of the housing and being spaced apart equally in a circumferential direction. [, e] Each groove [having] has a pair of side faces opposed to each other[, extending] and extends in the axial direction[, and] with a bottom portion [connecting] connected between the side faces. [, and a] A tripod is provided at an angle normal to a second rotating shaft and secured to one end of the second rotating shaft. [, t] The tripod has [having] three trunnions positioned in the grooves. [, t] The trunnions [being] are spaced apart equally in a circumferential direction and [securing] secured equally to the second rotating shaft at an angle normal. [, with r] Respective inner rollers [being] are mounted to outside end portions of respective trunnions [.] and [with] respective outer rollers [being] are mounted on the outer faces of inner rollers through a needle bearing. [, t] The outer faces of the outer rollers [being] are shaped so as to allow movement only in an axial direction of the grooves. [, e] Each of the trunnions [having] has a generally spherical outer face, and each of the inner rollers [having] has a generally spherical outer face. [, r] Respective generally spherical outer faces of the inner rollers [having] have approximately the same dimensions as respective generally spherical outer faces of the trunnions such that respective inner rollers may rotate and pivot freely on respective outer faces of respective outer face of respective trunnions.

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(cont'd) Page 5, final paragraph to page 6 first paragraph, please amend as follows;

The constant velocity joint of tripod type is characterized in that, on each outer face of each trunnion, there is provided a partially cylindrical area inclined relative to a trunnion centerline (Q). [, wherein t] The trunnion centerline (Q) means a line passing through a center (O) of the generally spherical outer face of the trunnion, perpendicular to a trunnion axis (M) of the trunnion, and being on a face including the trunnion axis (M) and a portion in contact with the inner roller, with a joint angle being zero. [, and wherein t] The trunnion axis (M) means an axis passing through the center (O) of the generally spherical outer face of the trunnion, and perpendicular to the second rotating

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(cont'd)
shaft.

Page 6, first full paragraph, please amend as follows;

In order to attain the above object, [further,] a constant velocity joint of tripod type according to the second aspect of the invention is characterized in that [.] a diameter (d) of each partially cylindrical area provided on each outer face of each trunnion is related to an inner diameter (D) of each inner joint end surface of each inner roller in accordance with the following formula:

$$(d) < (D)$$

$$\text{and } 5^\circ \leq \text{angle}(\theta),$$

wherein the angle(θ) is an angle of a line connecting between the center (O) of the trunnion and a farthest point (P), relative to the trunnion centerline (Q). [, a] An intersection line (13a) being an edge line of the partially cylindrical area at an inner side of a joint. [, t] The farthest point (P) being on a location where the intersection line (13a) is farthest from a center of a joint, on the outer face of the trunnion.

Page 7 to page 9, under the BRIEF DESCRIPTION OF THE DRAWINGS section, please amend the Figure descriptions as follows;

Figure 1A is a longitudinal cross-sectional view [shows cross-sectional views] of a primary portion of a tripod type constant velocity joint according to the first embodiment of the present invention [, where Figure 1 (a) is a longitudinal cross-sectional view, and Figure 1 (b) is a cross-sectional view];

Figure 1B is a cross-sectional view of the primary portion of the tripod type constant velocity joint according to the first embodiment of the present invention;

Figure 2 is a cross-sectional view of the first embodiment of the present invention;

Figure 3A is an explanatory view showing the assembly of a roller of the first embodiment of the present invention [, where Figure 3 (a) is an explanatory view showing the assembly of a roller, and Figure 3 (b) is an explanatory view showing an area that receives a load during movement];

Figure 3B is an explanatory view showing an area that receives a load during

movement of the first embodiment of the present invention;

Figure 4 is a cross-sectional view of a primary portion of the second embodiment of the present invention;

Figure 5 is a cross-sectional view of a primary portion of the third embodiment of the present invention;

Figure 6 is a cross-sectional view of a primary portion of the fourth embodiment of the present invention;

Figure 7 is a cross-sectional view showing a state of the fourth embodiment of the present invention with any joint angle present;

Figure 8 is an explanatory view showing a state of the fourth embodiment of the present invention in which a load is applied at one side of the trunnion;

Figure 9 is a view corresponding to Figure 8 with a joint angle present;

Figure 10 is a cross-sectional view of a primary portion of the fifth embodiment of the present invention;

Figure 11 is a cross-sectional view of a primary portion of the sixth embodiment of the present invention;

Figure 12 is a cross-sectional view of a primary portion of the seventh embodiment of the present invention;

Figure 13 is a cross-sectional view of a primary portion of the eighth embodiment of the present invention;

Figure 14 is an explanatory view showing a state of edge contact of the eighth embodiment of the present invention;

Figure 15 is a schematic perspective view showing a conventional prior art tripod type constant velocity joint;

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(cont'd) Figure 16 is a schematic partial cross-sectional view taken along the line A-A of Figure 15;

37 Figure 17 is an explanatory partial enlarged view of [a] another conventional prior art tripod constant velocity joint;

38 Figure 18 is an explanatory partial enlarged view of yet an another conventional prior art tripod constant velocity joint; and

39 Figure 19 is an explanatory partial enlarged view of a still another conventional

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(cont'd)

prior art tripod constant velocity joint.

Page 9, second full paragraph under the DESCRIPTION OF THE PREFERRED EMBODIMENTS section, please amend as follows;

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Figure 1 shows cross-sectional views of a tripod type constant velocity joint according to the first embodiment of the present invention, incorporated in a drive system of, for example, an automobile; wherein, Figure 1A [(a)] is a longitudinal cross-sectional view, and Figure 1B [(b)] is a cross-sectional view with a joint angle being zero.

Page 10, last paragraph to page 11 first paragraph, please amend as follows;

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When the constant velocity joint 1 as described above is used, for example, the first rotational shaft 2 is rotated. The rotational force of the first rotational shaft 2 is transmitted from the housing 3, through the roller assembly [9], the needle bearing 10 and the trunnion 8, to the boss 7 of the tripod 5, thereby rotating the second rotational shaft 4 the end of which is fixed to the boss 7. Further, if a central axis of the first rotational shaft 2 is not aligned with that of the second rotational shaft 4 (namely, a joint angle is not zero in the constant velocity joint 1), each of the trunnion 8 displaces relative to a side face of each of the [recesses] grooves 6 so as to pivot around the tripod 5. At this time, the outer rollers 16 supported at the ends of the trunnions 8 roll and move on the side faces 11a, 11b of the guide grooves 6, respectively, thereby absorbing any axial relative displacement occurring between the outer rollers 16 and the inner rollers 12. Such movements ensure that a constant velocity between the first and second rotational shafts 2 and 4 is achieved.

Page 11, second full paragraph, please amend as follows;

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Figure 2 is a cross-sectional view showing a tripod type constant velocity joint 1 of the first embodiment of the present invention with a joint angle being zero. Figure 3A [(a)] is an explanatory view showing an assembly of the inner rollers 12 on the trunnions 8; and Figure 3B [(b)] is an explanatory view showing an area of the trunnions 8 which receives a load.

Page 11, third full paragraph, please amend as follows;

As described earlier, the tripod type constant velocity joint 1 according to the first embodiment comprises a hollow housing 3 secured at an end of a first rotating shaft 2 (shown in Figure 1A [(a)]) serving as a drive shaft or the like and a tripod 5 secured at one end of the second rotating shaft 4 serving as a driven shaft or the like on the wheel side. Grooves 6, which are provided as recesses extending in the axial direction (a direction extending between the front side and the rear side in a paper of Figure 2) are formed on three locations at equal spacing on [the] an inner face of the housing 3 in the circumferential direction, and are recessed radially from the inner faces toward the outside of the housing 3.

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Page 11, last paragraph to page 12, first paragraph, please amend as follows;

Moreover, each of the guide grooves 6 of the housing 3 comprises a pair of opposed side faces 11a, 11b and a bottom portion 11c continuously connected to the both side faces 11a, 11b. The side faces 11a, 11b correspond to a convex spherical outer face of the [outside] outer roller 16, and hence is formed as a [circular recessed] spherical concave surface of approximately the same dimension as the outer face of the [outside] outer roller 16. The side faces 11a, 11b extend in the longitudinal direction of the housing 3 or the axial direction of the first [rotational] rotating shaft 2.

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Page 12, first full paragraph, please amend as follows;

Each of the bottom portions 11c of the guide grooves 6 is provided with the tracking guides 18a and 18b for guiding each of the outer rollers 16 in contact with [the] an outside end surface of the outer roller 16. In this way, the side faces 11a, 11b of the guide grooves 6 provide a tracking surface on which the [outside] outer roller 16 can slide and roll.

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Page 12, second full paragraph, please amend as follows;

The trunnion 8 has a generally spherical convex outer surface, the center of which lies along the trunnion axis (M) (described later). [; i] In addition, a partial cylindrical

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face 13 is formed on the outer surface of the trunnion 8 so as to be inclined relative to the trunnion centerline (Q) (described later). On the outer surfaces of the trunnions 8, respective inner rollers 12 are mounted to enable the trunnions 8 to pivot and rotate freely. The inner surface of the inner roller 12 has a generally spherical inner face which has similar dimensions to the outer surface of the trunnion 8, and is mounted directly on the outer surface of the trunnion 8. In addition, the inner roller 12 has a cylindrical outer surface [.] and the outer roller 16 has a cylindrical inner surface. [.] With the outer roller 16 being engaging with the inner roller 12 through the needle bearings 10. Further, the outer face of the outer roller 16 is in part spherical.

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Page 12, final full paragraph, please amend as follows;

Next, the way in which the inner roller 12 is fitted to the trunnion 8 will be described.

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Page 13, first full paragraph, please amend as follows;

Figure 3A [(a)] is an explanatory view showing the steps of fitting the inner roller 12 having [an inner] the spherical inner face [surface] to the trunnion 8 having [an] the spherical outer [spherical] surface.

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Page 13, second full paragraph, please amend as follows;

When (D) means an inner diameter of [the] an end face of the inner roller 12 at the joint inner side and (d) means a diameter of [a partially] the partial cylindrical face [area] 13 which is inclined relative to the trunnion centerline (Q) (described later), the relation of (d)<(D) exists. Consequently, as shown in Figure 3A [(a)], after making the end face of the inner roller 12 at the joint inner side parallel to the [partially] partial cylindrical face [area] 13 and bringing the inner roller 12 into contact with the trunnion 8, it becomes possible to install the inner roller 12 on the trunnion 8 by rotating the inner roller 12 with the inner face of the inner roller 12 being in contact with the outer surface [face] of the trunnion 8, as indicated by the arrows A1 and A2 in Figure 3A [(a)]. After installing the inner roller 12 on the trunnion 8, an allowable amount of pivot (of pivot angle) of the inner roller 12 on the spherical outer [spherical] surface (the direction

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indicated by arrow A2 in Figure 3A [(a)]) of the trunnion 8 is limited [enough small] to prevent detachment during use of [using] the joint 1.

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(cont'd)

Page 13, final full paragraph, please amend as follows;

Next, with reference to Figure 3B [(b)], the load applied to the trunnion 8 during operation will be explained. As shown in figure 3B [(b)], a point (O) is defined as a center of the trunnion 8, [which] The trunnion 8 is perpendicular to the second rotating shaft 4 (see Figure 1) and has [a] the spherical convex outer surface [face, and a] The trunnion axis (M) is defined as an axis which passes through the center (O) of the trunnion 8.

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Page 14, third full paragraph, please amend as follows;

~~SUB C. > When (θ) is defined as an angle of a line connecting between the farthest point (P) and the center (O) of the trunnion 8, relative to the trunnion centerline (Q), the angle (θ) is set to be $5^\circ < (\theta)$. Thus, a relatively large spherical outer surface area of the trunnion 8 is provided for receiving a load applying onto the outer surface [face] of the trunnion 8. Accordingly, an area for receiving the load is increased, thereby enabling contact stress to be dispersed.~~

Page 14, fourth full paragraph, please amend as follows;

According to the first embodiment of the invention, when the joint 1 is rotated with the usual joint angle present in attaching to an automobile, a force occurs due to up and down movements of the trunnion 8 relative to the outer roller 16 in the axial direction of the trunnion 8 (access of the roller). This force can be absorbed because the outer surface [face] of the inner roller 12 slides and rotates on [the] an inner face of the needle bearing 10 located between the outer roller 16 and the inner roller 12. Thus, a sliding resistance of the outer roller 16 can be significantly reduced or minimized, as compared to a pure sliding resistance of the prior art structure.

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Page 15, fifth full paragraph, please amend as follows;

The basic structure of the tripod type constant velocity joint 1 of Figure 4 has the

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(cont'd)

same structure as that defined in the first embodiment, as shown in Figure 2. However, in the structure shown in Figure 4, needle stoppers 16a and 16b are formed integral with the outer roller 16 around both circumferential ends of ~~an inner~~ the cylindrical inner surface ~~area~~ of the outer roller 16, so that the number of components can be reduced.

Page 15, last full paragraph, please amend as follows;

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Alternatively, it is also possible to constitute a structure wherein only a single needle stopper, either 16a or 16b, is formed to be integral with a circumferential end of ~~an inner~~ the cylindrical inner surface ~~area~~ of an outer roller 16 and the other needle stopper is a separate member.

Page 16, third full paragraph, please amend as follows;

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The basic structure of the tripod type constant velocity joint 1 of Figure 5 has the same structure as that defined in the first embodiment, as shown in Figure 2. However, in the structure shown in Figure 5, needle stoppers 12a and 12b are formed integral with the inner roller 12 around both circumferential ends of ~~an outer~~ the cylindrical outer surface ~~area~~ of the inner roller 12, so that the number of components can be reduced.

Page 16, fourth full paragraph, please amend as follows;

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Alternatively, it is also possible to constitute a structure wherein only a single needle stopper, either 12a or 12b, is formed to be integral with a circumferential end of ~~an outer~~ the cylindrical outer surface ~~area~~ of ~~an~~ the inner roller 12 and the other needle stopper is a separate member.

Page 17, last paragraph to page 18, first paragraph, please amend as follows;

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When the joint 1 is rotated with any joint angle present, the trunnion centerline (Q) of the trunnion 8 shifts toward the inside of the joint 1 relative to the groove centerline (N) as shown in Figure 7. If there is a large offset toward the inside of the joint 1 from the groove centerline (N) to the trunnion centerline (Q) with a joint angle being zero, the offset is more increased with a joint angle present. If the offset becomes ~~more large~~ larger as in the latter case, the outer roller 16 receives a load on the groove

B26 (contd)

centerline (N), while the inner roller 18 receives a load on the centerline (Q), as shown in Figure 8. As a result of an offset between load points onto the loads are applied, a counter clockwise moment is generated around an axis connecting the both loaded points, in Figure 8. This moment tends to rotate the outer roller 16 counterclockwise toward the inner direction of the joint (the direction shown by an arrow in Figure 8) at the opposite side of the loaded points. Thus, the moment causes the outer roller 16 to be highly pressed onto the inner [radial side] face of the housing 3 of the side face 11a of the guide groove 6 at the opposite side of the loaded points, bringing about any undesirable resistance to a rotation of the outer roller 16 which would be desirable to be avoided.

Page 18, first full paragraph, please amend as follows;

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In the fourth embodiment of the present invention, as shown in the Figure 6, the offset (δ) between the trunnion centerline (Q) and the groove centerline (N) with a joint angle being zero is set to be $-0.02Ro < \delta \leq 0.093Ro$, wherein Ro is a radius of outer face of outer roller 16 ~~{16}~~. Therefore, the offset can be kept small with any joint angle present. Consequently, it is possible to eliminate a generation of excessive moment on the outer roller 16, thereby avoiding excessive contact pressure between the groove 6 ~~{11a}~~ of the housing 3 and the outer roller 16 at the opposite side of the loaded side; whereby it is possible to obtain a low axial force and minimizes any rolling resistance acting against the outer roller 16.

Page 18, last paragraph to page 19, first paragraph, please amend as follows;

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The main difference in the fifth embodiment from the first embodiment is that the inner diameter(ϕd_o) of the needle stopper or rim 16b formed at the end of the inside of the joint 1 on the ~~{inner}~~ cylindrical inner surface of the outer roller 16 is made to be smaller than the outer diameter(ϕD_i) of the inner roller 12. In Figure 10, like components described in the first embodiment of the present invention, and shown in Figure 2, are designated by the same symbols. Additionally, since the basic structure of the fifth embodiment of the present invention is the same as that of the first embodiment, primarily, the details regarding the different components will be described hereinafter.

Page 19, first full paragraph, please amend as follows;

Figure 10 is a cross-sectional view showing the fifth embodiment of the present invention. In the fifth embodiment, the relation $(\phi_{do}) < (\phi_{Di})$ is provided, wherein ϕ_{do} is an inner diameter of the needle stopper or rim 16b formed on the ~~inner~~ cylindrical inner surface of the outer roller 16 at the inside of the joint 1 and ϕ_{Di} is an outer diameter of the inner roller 12. Therefore, it is difficult for the outer roller 16 to be detached from the inner roller 12. Further it is difficult for the needle bearing 10 to be detached from the inner rollers 12 and the outer rollers 16, since the outer roller 16 engages with a boss 7 of the tripod 5 when it is moved to inner radial side. Accordingly, it can be very easy to handle the assembled tripod 5 (in which the tripod 5, the inner rollers 12, the needle roller bearings 10, and the outer rollers 16 are assembled together).

Page 19, last paragraph to page 20, first paragraph, please amend as follows;

The main difference in the sixth embodiment from the first embodiment is that the outer diameter(ϕ_{Dii}) of the needle stopper or rim 12a formed at the end of the outside of the joint 1 on the ~~outer~~ cylindrical outer surface of the inner roller 12 is made to be smaller than the inner diameter(ϕ_{doo}) of the outer roller 16. In Figure 11, like components described in the first embodiment of the present invention, and shown in Figure 2, are designated by the same symbols. Additionally, since the basic structure of the sixth embodiment of the present invention is the same as that of the first embodiment, primarily, the details regarding the different components will be described hereinafter.

Page 20, first full paragraph, please amend as follows;

Figure 11 is a cross-sectional view showing the sixth embodiment of the present invention. In the sixth embodiment, the relation $(\phi_{doo}) < (\phi_{Dii})$ is provided, wherein ϕ_{Dii} is an outer diameter of the needle stopper or rim 12a formed at the end of the outside of the joint 1 on the ~~outer~~ cylindrical outer surface of the inner roller 12 and ϕ_{doo} is an inner diameter of the outer roller 16. Therefore, it is difficult for the outer roller 16 to be detached from the inner roller 12. Accordingly, it can be very easy to handle the assembled tripod 5 (in which the tripod 5, the inner rollers 12, the needle roller bearings 10, and the outer rollers 16 are assembled together).

Page 20, last paragraph to page 21, first paragraph, please amend as follows;

The main difference in the seventh embodiment from the first embodiment is that the longitudinal cross radius (r) of the inner roller 12 is [made] formed to be larger than the longitudinal cross radius (R) of the trunnion 8. In Figure 12, like components described in the first embodiment of the present invention, and shown in Figure 2, are designated by the same symbols. Additionally, since the basic structure of the seventh embodiment of the present invention is the same as that of the first embodiment, primarily, the details regarding the different components will be described hereinafter.

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Page 21, first full paragraph, please amend as follows;

Figure 12 is a cross-sectional view of the inner roller 12 and the trunnion 8, according to the seventh embodiment. In the seventh embodiment, when (r) is a radius of a longitudinal cross-sectional shape of [an] the inner face of the inner roller 12 and (R) is a radius of a longitudinal cross-sectional shape of [an] the outer surface [face] of the trunnion 8, the following relations exist;

$$(r) \geq (\text{diameter of trunnion } 8) / 2$$

$$\text{and } (R) \leq (\text{diameter of trunnion } 8) / 2$$

$$\text{and } (R) < (r) \leq (3.8 R)$$

By setting in this way, sufficient grease-entry spaces are provided at both inner and outer sides to enable better greasing of the loaded contact area between the inner roller 12 and the trunnion 8. As a result, frictional resistance between the inner roller 12 and the trunnion 8 is minimized, providing remarkably improved smoothness of operation and in durability as compared with the prior art.

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Page 21, last paragraph to page 22, first paragraph, please amend as follows;

On the contrary, the seventh embodiment of the invention makes the radius (R) of the outer face of the trunnion 8 smaller than the radius (r) of the inner face of the inner roller 12. Thus, the trunnion 8 moves rolling on the inner face of the inner roller 12. Accordingly, a friction between the inner face of the inner roller 12 and the outer surface [face] of the trunnion 8 can be reduced, thereby attaining a significant reduction of the

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axial movements of the trunnion 8.

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(cont'd)*
Page 22, first full paragraph, please amend as follows;

Next, the eighth embodiment of the present invention will be described with reference to Figures 13 and 14. Figure 13 is a cross-sectional view showing the eighth embodiment, and Figure 14 is a schematic view in which the outer roller 16 [15] and the tracking guide 18b (or 18a) are in contact with each other at their edges.

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Page 22, second full paragraph, please amend as follows;

The main difference in the eighth embodiment from the first embodiment is that the outer roller 16 has a R-shaped chamfer which is in contact with the tracking guide 18b (or 18a) and is then guided by the same, and this R-shaped chamfer is continuous with the ~~outer~~ outside end surface. In Figure 13, like components described in the first embodiment of the present invention, and shown in Figure 2, are designated by the same symbols. Additionally, since the basic structure of the seventh embodiment of the present invention is the same as that of the first embodiment, primarily, the details regarding the different components will be described hereinafter.

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Page 22, last paragraph to page 23, first paragraph, please amend as follows;

In a conventional tripod type constant velocity joint 1, when it is rotated with any joint angle present, an outer roller 16 rolls along the grooves 11a and 11b parallel to the first rotating shaft 2, transmitting this rotation. At this time, as shown in Figure 14, the outer roller 16 is guided by the tracking guide 18b (or 18a) and rolls with an angle of inclination (α) relative to the tracking guide 18b (or 18a), due to the axial and pivotal movements of the trunnion 8 and the outer roller 16. Additionally, the ~~outer~~ outside end surface ~~edge~~ of the outer roller 16 makes edge contact with the tracking guide 18b (or 18a), which causes an increase in frictional resistance against movement of the outer roller 16.

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Page 23, first full paragraph, please amend as follows;

In the eighth embodiment of the present invention, the ~~outer~~ outside end surface